thirteenth embodiment of the invention is not restricted by the method mentioned above.

As described above according to the thirteenth embodiment of the present invention, when focus jumping is performed in the dual-layer disk, a tracking offset correction value corresponding to a desired target position of the tracking control means on each of the first information face and the second information face of the disk is stored in the tracking position storage means and, when focus jumping is performed this time, the target position of the tracking control means is changed to an optimum value for the target information face. Therefore, a stable tracking servo system can be constructed for either information face.

Embodiment 14

A description is given of a tracking control offset learning for a multiple-layer disk in an optical disk apparatus according to a fourteenth embodiment of the present invention, using FIG. **24**. In this embodiment, a dual-layer disk is employed.

FIG. **24** is a block diagram illustrating the inner structure of the DSP **129** for explaining a phase difference tracking servo system and a section for correcting an offset due to the phase difference (hereinafter referred to as a phase difference offset) according to the fourteenth embodiment of the present invention.

When the optical disk apparatus is turned on and the dual-layer disk is loaded in the apparatus, the disk motor **102** is rotated at a prescribed speed (DMON). Next, the semiconductor laser **108** is oscillated (LDON), and the focus of the light beam **107***a* emitted from the laser **108** is led in the second layer L1 of the dual-layer disk. In the state where the focus is led in, a send wave shaped track cross signal as shown in FIG. **25**(*a*) appears on the TE signal due to a decentration.

In the DSP **129**, the lens shifter **310** applies a signal to the composition circuit **304** and gives an offset to the tracking actuator **103** by compulsorily flowing current in the actuator **103**, whereby the focusing lens **105** is shifted by about +300 μm. In the state where the lens **105** is shifted, the symmetry detector **318** samples the sine wave shaped TE signal, detects a maximum value and a minimum value of the TE signal, and calculates a symmetry Voff+ tracking on the positive side of the lens shift. Alternatively, this symmetry may be obtained by integrating the sampled TE value.

Next, the polarity of the output signal from the lens shifter **317** is changed so that the lens **105** is sifted by about −300 μm. In this state, the symmetry detector **318** samples the sine wave shaped TE signal, detects a maximum value and a minimum value of the TE signal, and calculates a symmetry Voff− of tracking on the negative side of the lens shift. Alternatively, this symmetry may be obtained by integrating the sampled TE value.

Then, the variable delay elements **315** and **316** vary the delay (or lead) Pd1 so that the difference of the positive and negative lens-shift offsets attains a minimum value.

When the setting of the delay of the variable delay elements.**315** and **316**, which delay is a correction value of the phase difference offset of the phase difference tracking on the information face L1, and the storage of the set value in the phase difference correction value storage part **319** are completed, the focus of the light beam is moved to the information face L0 by the above-mentioned focus jumping.

On the information face L0, the tracking control is turned off and the focus control is turned on, an optimum delay Pd0 for correcting the phase difference offset is, obtained.

When the delays (or leads) Pd1 and Pd0 of the variable delay elements **315** and **316** for the information faces L1 and L0, respectively, are obtained, output values for setting the delays are input to the phase difference correction value storage part **319**.

After the phase difference correction value storage part **319** once stores the set values Pd1 and Pd0 for correcting the phase difference offset of the phase difference tracking, the DSP **129** selects a delay corresponding to the information face on which the light beam is no controlled, and sends this delay through the switch **319***a* to the variable delay circuits **315** and **316**.

Therefore, in either case where the focus of the light beam moves from L0 to L1 or from L1 to L0 in the dual-layer disk, when the focus jumping is performed to a target information face, the delay (Pd1 or Pd0) of the variable delay Circuits **315** and **316** corresponding to the target Information face is set, the offset of the tracking servo system when the lens **105** is shifed can be always eliminated, resulting in a stable tracking servo system.

By the way, a variety of methods have been proposed for the measurement and correction of the offset, and this fourteenth embodiment of the invention is not restricted by the method mentioned above.

As described above, according to the fourteenth embodiment of the present invention, a phase difference track error signal corresponding to the positional relationship between the focal point of the light beam and the track on each information face is produced on the basis of the phase relationship of signals output from respective light responsive parts of the light detecting means which receives reflected light from the recording medium. The tracking control means controls the tracking by driving the light beam moving means according to an output signal from the phase difference track error detecting means. Delays or leads of signals output from the respective light responsive parts of the light detecting means, which delays or leads provide desired values for output signals from the phase difference track error detecting means on the first information face and the second information face of the recording medium, are stored while performing focus jumping and seeking by the focus jumping means. When focus jumping and seeking are actually performed for a target information face, the delays or leads of the signals from the respective light responsive parts of the light detecting means are changed to the phase offset signal that is read out from the phase offset storage means and corresponds to the target information face. Therefore, in the dual-layer disk, when focus jumping is performed between the two information faces, since the focus offset correction value corresponding to the target information face is set, the offset in the tracking servo system can be always eliminated, whereby a stable tracking servo system can be constructed.

What is claimed is:

1. An optical disk apparatus comprising:

a focusing means for focusing a light beam on a recording medium having first and second information faces;

a moving means for moving a focal point of the light beam focused by said focusing means in a direction substantially perpendicular to the information faces of the recording medium;

a light detecting means for detecting a reflected light of the focused light beam from the recording medium;

a focus control means for detecting a focus condition of the light beam irradiating the information faces on the basis of an output signal from said light detecting

means, driving said moving means on the basis of the detection signal, and controlling the light beam so that the focus condition of the light beam becomes a prescribed focus condition;

a focus jumping means for jumping the focal point of the light beam to a target information face which is one of the first information face and the second information face by driving said moving means; and

a storage means for storing signals obtained when the focal point of the light beam is passed through the first and second information faces by driving said moving means so that the light beam goes away from or close to the recording medium;

wherein, when a focus jumping is performed by said focus jumping means, a gain of said focus control means is changed according to the values stored in said storage means.

2. An apparatus as claimed in claim 1, wherein said storage means stores signals corresponding to an amount of reflected light which is detected by said light detecting means when the focal point of the light beam is passed through the first and second information faces by driving said moving means so that the light beam goes away from or close to the recording medium.

3. An apparatus as claimed in claim 2, wherein, when the focus jumping is performed by said focus jumping means, a focus control lead-in level is set according to the values stored in said storage means.

4. An apparatus as claimed in claim 2, wherein a focus control lead-in level for the focus jumping is set according to the value stored in said storage means, a gain of which is changed according to the values stored in said storage means.

5. An apparatus as claimed in claim 1, wherein said storage means stores focus condition detecting signals obtained when the focal point of the light beam is passed through the first and second information faces by driving said moving means so that the light beam goes away from or close to the recording medium, wherein said focus condition detecting signal comprises at least one of a gain, an offset, and a level, and wherein, when the focus jumping is performed by said focus jumping means, at least one of a gain, an offset, and a level of said focus control means is changed according to the values stored in said storage means.

6. An apparatus as claimed in claim 5, wherein, when the focus jumping is performed by said focus jumping means, a focus control lead-in level is set according to the values stored in said storage means.

7. An apparatus as claimed in claim 5, wherein a focus control lead-in level for the focus jumping is set according to the value stored in said storage means, a gain of which is changed according to the values stored in said storage means.

8. An optical disk apparatus for reproducing information recorded on a recording medium having two information faces, by irradiating the recording medium with a focused light beam, said apparatus comprising:

a moving means for moving a focal point of the light beam irradiating the recording medium so that the focal point crosses a track on the recording medium;

a tracking control means for detecting a positional error between the focal point of the light beam and the track on the recording medium, driving said moving means according to the track error signal, and controlling the light beam so that the focal point is positioned on the track;

a focus jumping means for jumping the focal point of the light beam to a target information face, which is one of the first information face and the second information face, and seeking the target information face;

a storage means for storing tracking condition signals for the first information face and the second information face;

an arithmetic means for performing an arithmetic operation on the tracking condition signals stored in said storage means with an output signal from said tracking control means, and

a system control means for controlling the system so that a tracking condition signal which is read out of said storage means and corresponds to the target information face is used to adjust the output signal from the tracking control means, when the jumping and seeking are performed by said focus jumping means.

9. An apparatus as claimed in claim 8, wherein the tracking condition signals stored in said storage means are decentration signals which corresponding to decentrations of tracks on the first information face and the second information face, said arithmetic means is an adding means for adding the decentration signals stored in said storage means to the output signal from said tracking control means, and said system control means controls the system so that a decentration signal which is read out of said storage means and corresponds to the target information face is added to the output signal from said tracking control means, when the jumping and seeking are performed by said focus jumping means.

10. An apparatus as claimed in claim 8, wherein the tracking condition signals stored in said storage means are desired loop gains of said tracking control means for the first information face and the second information face, said arithmetic means is a multiplication means for multiplying the track gain signals stored in said storage means by an output signal from said tracking control means, and said system control means controls the system so that a tracking gain signal which is read out of said storage means and corresponds to the target information face is multiplied by the output signal from the tracking control means, when the jumping and seeking are performed by said focus jumping means.

11. An optical disk apparatus as claimed in claim 1, wherein said signals stored in said storage means are desired loop gains of said focus control means for the first information face and the second information face, and said optical disk apparatus further comprising;

a multiplication means for multiplying the focus gain signals stored in said storage means by an output signal from said focus control means; and

a system control means for controlling the system so that a focus gain signal which is read out of said storage means and corresponds to the target information face is multiplied by the output signal from said focus control means.

12. An optical disk apparatus as claimed in claim 1, wherein said signals stored in said storage means are servo offsets corresponding to desired target positions of said focus control means on the first information face and the second information face, and said optical disk apparatus further comprises:

a system control means for controlling the system so that the target position of said focus control means is changed to a focus position signal that is read out of said storage means and corresponds to the target information face.

13. An optical disk apparatus as claimed in claim **8**, wherein said signals stored in said storage means are servo offsets corresponding to desired target positions of said tracking control means on the first information face and the second information face, and said optical disk apparatus further comprises:

a system control means for controlling the system so that the target position of said tracking control means is changed to a tracking position signal that is read out of said storage means and corresponds to the target information face.

14. An optical disk apparatus as claimed in claim **8**, further comprising:

a light detecting means for detecting a reflected light from the recording medium at a plurality of light responsive parts;

a phase difference track error detecting means for generating a phase difference track error signal corresponding to the positional relationship between the focal point of the light beam and the track on each information face, on the basis of the phase relationship of signals output from the respective light responsive parts of said light detecting mean; and

wherein said tracking control means drives said moving means according to an output signal from said phase difference track error detecting means, and controls the light beam on the information face so that the focal point of the light beam seeks the track correctly;

wherein said storage means stores delays or leads of signals output from the respective light responsive parts of said light detecting means, the delays or leads providing desired values for output signals from said phase difference track error detecting means on the first information face and the second information face; and

wherein said system control means controls the system so that the delays or leads of the signals from the respective light responsive parts of said light detecting means are changed to a phase offset signal that is read out from said storage means and corresponds to the target information face when the jumping and seeking are performed by said focus jumping means.

15. An optical disk apparatus as claimed in claim **8**, wherein said storage means stores a parameter of a focus control and a tracking control corresponding to the first and second information face, and the parameter of the focus control and tracking control is changed when a jumping is performed by said focus jumping means.

* * * * *